

feet in thickness. Out of a portion of this deposit, weighing perhaps three or four pounds, I have prepared and mounted forty-six species of Polyzoa, eight species of Foraminifera, comprising Globigerina, Textularia, Dentalina, Operculina, Rosalina, Rotalia, Nodosaria, three species of Lagena, and siliceous spicules of Tethya and Grantia. After boiling the material, repeated washing and drying, it is then subjected to a bleaching process, consisting of the action of sulphuric acid on bicarbonate of soda in solution. After sifting, the finest portion in which the Foraminifera are found is then macerated in turpentine for a few days, the shells are then selected and placed in Canada balsam on slides heated on a metal plate over a spirit lamp, and the specimens before you will show that it is possible to mount them tolerably transparent and free from air bubbles.

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ART. XXII.—*Report on the Entrance to the Gipps Land Lakes.* By THOMAS E. RAWLINSON.

[Read June 2nd, 1863.]

Road Engineer's Office, Sale, 14th February, 1863.

To the Assistant-Commissioner of Roads and Bridges.

SIR,—1. I have the honor to report having placed myself in communication with Mr. District Surveyor Dawson, relative to making a survey of the entrance to the Gipps Land Lakes, as per your instructions of the 30th ultimo.

2. From the correspondence on the subject, which I have looked over, I learn that you decline to authorise any expenses, on the ground of "no funds," and, in answer to my inquiries, Mr. Dawson informs me that he does not feel authorised in incurring any expenses, beyond those absolutely required for his own especial service, under which circumstances, I have declined to absent myself from the numerous urgent duties of this district, until I have had further instructions from you on the subject.

3. I have adopted this course because the proposed visit, under such circumstances, would not place me in any better position to report on the facts than I am in at the present time, for, in July 1861, during the period of my official visit to McLennan's Straits and the Mitchell, I had, through the kindness of Messrs. McArdle and Raphael, an opportunity of making such inspection as the present proposed one

would be, and I have had information of such changes as have taken place at the entrance, since the date of my visit.

4. The opinions formed by me on the spot eighteen months ago, have remained unchanged and unmodified, although I have taken all reasonable means to learn what could be advanced for or against the entrance in the interim.

5. Since the date of my visit, the entrance appears to have worn its way considerably more to the north-east, and more directly under the sandstone bluff which at that place projects seawards, through the otherwise monotonous stretch of sand dunes forming the Ninety-Mile Beach. The waters of Lake Bunga would also appear to be drained off, for I am told that, instead of a running stream, as at the time of my visit, the channel is now nearly dry, but this latter point is of very little importance.

6. Having premised this much, I will, with your permission, submit the opinions which I have arrived at, leaving you to estimate their value, seeing that they are almost wholly the result of inferential reasoning on certain physical features and phenomena, rather than deductions from a series of ascertained facts.

7. For the sake of clearness, I will preface my opinions with a brief sketch of the locality, with such general observations as I have been able to make during the limited opportunities which I have had for such.

8. The south-east coast of Gipps Land, from Corner Inlet to Cape Howe, extends in an almost unbroken line, over about three degrees of longitude and one degree of latitude, bearing in a general direction from Corner Inlet north-east, and gradually edging round to the east until off the Ram Head, when it suddenly trends away in a north-easterly direction to Cape Howe, the south-eastern extremity of the colony and of the Australian Continent.

9. The coast from Corner Inlet to the entrance to the Lakes (a distance of nearly 100 miles) is composed of low sand dunes, backed with a considerable expanse of low, flat country, and shallow lakes and lagoons, and only broken in its outline by the entrance to Port Albert, Shallow Inlet, Merriman's Creek, and the Lakes. Shallow Inlet and Merriman's Creek entrances are occasionally blocked up with drift sand, and such I have been informed was the case with the entrance to the Lakes at no very remote period.

10. North-east of the existing lake entrance a sandstone

bluff rises of a somewhat similar character to that at Point Lonsdale, at the entrance to Port Phillip Gulf, but in this case having a reef of rocks extending seawards for a short distance, which affords to some extent shelter to the present entrance, and will be useful as a foundation for any works projected hereafter.

11. From the lake entrance, north-easterly to Cape Howe, I know nothing of the coast, other than can be gleaned from maps and general report, but I believe that it gradually assumes a bolder and more decided character after passing the Snowy River, but without breaks of importance, or harbours on the line of coast. The Snowy River is quite out of the question as a refuge in stress of weather.

12. The whole of the coast from Corner Inlet to the entrance of the lakes (a distance of nearly 100 miles) presents unmistakable evidence of recent formation, but whether such has been caused by upheaval or by drift and deposit, or all three causes combined, I am unable to say, but incline to the belief that it is due chiefly to the two latter causes, because of the peculiar formation of the apparently magnificent, but in reality shallow, sheets of water which back the coast, and of the river formations.

13. The physical features of the two chief rivers which empty into the lakes, namely, the Latrobe and the Mitchell (but more especially the former), with their remarkable deltas and great extent of low swamp land and morasses, (which form the river valley bottoms) impress the mind of the observer with the conviction, that at no distant date the sites of the morasses were open firths or estuaries, up which the waters of the Southern Ocean rolled, without let or hindrance from the now existent tea-tree flats and sand dunes, which form the shore and land of the Ninety-Mile Beach.

14. The causes which have filled up so large an extent of valley as that of the Latrobe (namely, deposition of mud and the accumulation of vegetable matter), are still in operation, extending the river deltas, and silting up the lakes, as evidenced by the deposits of fine mud and dense vegetation in the shallow water around their edges, and the shoals in the centre, and in addition, to the above causes there is the sand drift blown over in gales of wind.

15. The tendency to form deposit in the lakes is, I have not the slightest doubt, very much increased by the percolation of their waters through the narrow isthmus of sand

which divides them from the ocean, for a distance of nearly sixty miles. The loss of water by percolation must of necessity reduce the scouring power of the currents of river waters passing through the lakes.

16. Without some tangible cause, such as percolation, it is difficult to account for the expenditure of the very large bodies of water continually flowing into these lakes, from a watershed of upwards of 5,600 square miles, by such rivers as the Latrobe and its large tributaries, the Thompson and Macalister, the Avon and its large tributaries, the Mitchell and its large tributaries, the Nicholson, and the Tambo with its large tributaries, for the outflow by the present entrance is not nearly sufficient, even after making the most liberal allowance for loss by evaporation and for absorption by the vegetation of the lakes. The loss from absorption by penetration of the substrata must be *nil*. From such reasoning I am forced to the conclusion, that much water passes away by percolation, and that being so lost, the retaining (*sic*) banks are not impervious. Such reasoning may be the *reductio ad absurdum*, but the necessity for it will be seen when referring to the project for impounding water in this porous reservoir.

17. With reference to the moot question, as to the practicability, or in other words the accessibility of the entrance, I have always been of opinion that it is entirely a question for a seaman to decide, and that such a question should be decided affirmatively, before any works are undertaken to improve the entrance. For, in the first place, there are nearly 200 miles of coast exposed to the full fury of the Southern Ocean, and to all the winds that blow from south, round by south-east to east, and that for the greater portion of this length, the coast would be a lee shore during the period for which the winds blew from one-half the points of the above quarter of the compass, without a single place for shelter or refuge throughout its whole extent. In addition to the above, the coast line being concave, any ordinary vessel hugging the land, with a view to making the entrance, must of necessity either enter or go ashore, in which latter case, the result would be total loss of property, if not of life, on such a coast. Even with what, under ordinary circumstances would be a good offing, it would require first-class seamanship and good weatherly qualities to enable any sailing vessel to escape (if caught in such a place by a gale from the south-east or from other points near to that quarter), by

either rounding Cape Howe or making Corner Inlet, for anchoring or lying-to would be out of the question.

18. Owing to the monotonous character of the coast over such a large extent of its length, and which is only broken by a low bluff, which, when viewed from seawards must be merged generally in the sombre tone of the high lands behind, the entrance would at all times be an uncertain one to make, but more especially so, when obscured by the loom which is so common an accompaniment to a low sea beach and shore ; and it is such a circumstance as this, which would necessitate hugging the land more or less, even by the most careful shipmasters, and so lead them into a trap from which there would be no escape.

19. The above are some of the difficulties which present themselves to my mind, in connection with this question, but I can only submit them for what they are worth, seeing that I am no seaman, and have no knowledge of nautical matters other than what falls within the province of my profession as an engineer.

20. In my ignorance of maritime affairs I may have over-rated the above difficulties, but even at the risk of being judged harshly on this matter, I have deemed it better to point them out, as I believe them to exist, seeing that engineering science is impotent in reference thereto. It must not be forgotten that, unless a reasonable amount of confidence is established in the practicability of the entrance, Lloyds' will not insure, nor will shippers risk, on such a passage, unless under very exceptional circumstances.

21. Having so far considered that which I conceived to be the primary question, namely, the natural but irremovable difficulties presented, I now propose to consider, in so far as it can be done at present, the question of improving and giving permanency to the entrance, should the above stated difficulties not be deemed insuperable.

22. With reference to the scheme submitted some time back for deepening and securing the entrance by a system of sluicing, and for that purpose impounding the waters for a time, I can only say, that if the proposer can successfully perform such an operation in such a locality by such means, I must most respectfully bow to him as a master in the science, for I believe it to be an operation that no other engineer can perform under such circumstances. The sluicing scheme is based on a violation of one of the first laws of hydrostatics, namely, that fluids seek the line of least resist-

ance, which in the particular case in question, would most decidedly be upwards ; consequently the scouring power, if it acted at all, would be first employed in scooping out the foundations in front of the gate, and then rise to the surface and flow away, as a surface current, over the denser waters of the ocean, until their force was lost. In addition to ignoring known laws, the estimated cost was very small (£4,000 to £5,000), for it is well-known to engineers that foundations for such a work on a sandy beach are expensive, and in some cases virtually impracticable. I have before shewn on what grounds I believe the isthmus (which would have to form one of the retaining banks for the impounded water) to be porous, and I cannot learn that any attempt has ever been made, by boring or other means, to ascertain the depth of the porous materials, without which data it is mere empiricism to attempt giving an estimate of the cost.

23. From what I have seen of the locality, I believe that nothing but dredging will be effectual to any extent for deepening and removing the bar, and that to be efficient it would require to be constant, for upon a cessation of work the causes in operation, which formed the first bar, not being removed, would speedily re-form it under similar conditions.

24. To protect the entrance with a breakwater would simply extend the evil of the bar a little further out to sea, without giving any increased security to the entrance, although I believe that it would give permanence for such time as the breakwater itself could withstand the sweep of sea falling on such a coast.

25. In the absence of all data on which to base an estimate, I feel that it would be futile in me to put forward such, but at the same time, I venture to state, that, supposing all other difficulties were disposed of satisfactorily, it would be quite useless to commence any work at the entrance with a view to improvement or permanence, with a less sum than £20,000 to begin with, of which at least from £400 to £500 would require to be spent by the engineer in preliminary surveys and works.

26. In conclusion, I can only regret the great imperfection of this report in not being more fully based on positive data, and I deeply regret the mischance which prevents my proceeding to the entrance to obtain such, so that, if possible, the problem of the lake entrance might be solved on grounds that would be indisputable.

27. I estimate the cost of such an examination as I should

recommend at about £200. The examination would consist of soundings around the entrance and the channels of the lakes and the bars of the rivers, borings to learn the nature of the strata at the entrance, guaging of the several rivers and the entrance to the lakes, together with a series of tidal observations, and the set of the currents and prevailing winds.

28. Trusting that you will approve of my course of action on this matter,

I have the honor to be, Sir, your obedient servant,

THOMAS E. RAWLINSON, Road Engineer.

NOTE.—Since my report on the lake entrance was submitted, the report of the District Surveyor on the same subject has been published, and I beg to call attention to its general tenor and statements.

Although written by a gentleman who has evident sympathies in favour of the feasibilities of the lake entrance, I think an impartial reader will perceive that the facts and admissions contained therein are nearly all more or less in support of the views which I have advanced on the subject.

Seeing that I have not the means of submitting the surveyor's report for the information of the members, I feel that it would be unfair to extend my comments on the same beyond this note.

The opinions advanced by me in the preceding report as to the difficulties and dangers of the entrance, are borne out by the recently issued report of the Chief Harbour Master, Capt. Ferguson.

17th Jan. 1865.

T. E. R.

Since the date of the report three sailing vessels have been lost and two steamers have been banked in.

T. E. R.

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ART. XXIII.—*On the Determination of Personal Equation in Astronomical Observing.* By ROBERT L. J. ELLERY, ESQ., F.R.A.S., Government Astronomer.

[Abstract of a paper read 2nd November, 1863.]

This was a short paper read principally to describe a small apparatus devised by Mr. Ellery for the purpose of obtaining the personal equation of different observers under conditions, as far as possible, similar to those under which the usual astronomical observations are made. It consists of an artificial star made to move across the field of view of the transit instrument at about the rate of an equatorial star, and to give a galvanic signal, on the chronograph apparatus, at the instant its position corresponds with the centre wire of the Micrometer, the observer also making a signal at the instant he observed the star to cross it. The difference of time, as shown on the chronograph, obtained for each observer, gives the means of ascertaining the personal